UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/535,346	10/03/2005	Tadashi Ishikawa	52433/797	7148

26646 7590 04/14/2009

KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

EXAMINER	
SHEVIN, MARK L	
ART UNIT	PAPER NUMBER
1793	
MAIL DATE	DELIVERY MODE
04/14/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/535,346	ISHIKAWA ET AL.	
	Examiner	Art Unit	
	MARK L. SHEVIN	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 January 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

1. Claims 1-5, filed January 28th, 2009, are pending.

Acknowledgement of RCE

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 28th, 2009 has been entered.

Claim Rejections - 35 USC § 103

3. **Claims 1-5** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Statnikov** (US 6,338,765) in view of **Lu** (K. Lu, Nanocrystalline metals crystallized from amorphous solids: nanocrystallization, structure, and properties, *Materials Science and Engineering,* R16 (1996) p. 161-221.) and **Wang** (X.Y. Wang and D.Y. Li, Mechanical and electrochemical behavior of nanocrystalline surface of 304 stainless steel, *Electrochimica Acta*, 47, (2002), p. 3939-3947.)

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Regarding claims 1 and 2, Statnikov teaches a method of subjecting the surface layer of a metallic product (steel, bronze, welded bodies, see Abstract) to ultrasonic

impact treatment (column 5, lines 23-40). Statnikov teaches that amorphous "white layers" **(claim 2)** are desirable and may be formed on the surface of a product depending on ultrasonic impact treatment parameters. These "white layers are formed on the treated body surface" (column 7, line 5) and are substantially devoid of grain structure and therefore amorphous (column 7, lines 20-31). Lastly Statnikov teaches that these white layers are desirable because they provide higher fatigue and corrosion resistance along with higher load carrying ability due to redistributed residual stresses (column 7, lines 25-31).

The Examiner assumes the ultrasonic indenter used to effect ultrasonic impact treatment inherently "vibrates in a plurality of directions", necessarily towards surface of material to produce an impact and then away again to regain momentum (i.e. up and down).

Statnikov does not teach step 2, heat treatment to precipitate nanocrystals.

Lu teaches heat treatment as a basic principle for crystallizing ultrafine crystallites, in particular nanocrystals. The crystallization kinetics can be controlled by optimizing the heat treatment conditions including annealing temperature and time (p. 163, para 2, lines 1-4, **claim 6**). Lu also teaches that nanocrystalline materials often have superior mechanical properties compared to larger grained polycrystalline materials and amorphous materials in terms of ductility, strength, hardness, and diffusivity (p. 161, para 1, lines 6-12).

Lu does not, however, teach the temperature and time for a heat treatment to cause the precipitation of nanocrystals.

Wang, drawn to studies of the nanocrystalline surface layer of steel produced by an analogous severe plastic deformation route (sand-blasting compared to ultrasonic peening), teaches the nanocrystallization of the surface layer resulted in enhanced mechanical properties and improved corrosion resistance (Abstract). Annealing the nanocrystalline layer formed after sandblasting at 350 °C for 60 minutes both increased hardness (Table 2) and increased corrosion resistance and passivation film performance (p. 3943, col. 1, para 2 and Table 3).

It would have been obvious to one of ordinary skill in the metallurgical arts at the time the invention was made to combine produce nanocrystalline surface layers through ultrasonic impact treatment and subsequent heating as Statnikov taught that the amorphous white layers were a product of ultrasonic impact treatment and Lu taught that in general an amorphous microstructure can be converted to a nanocrystalline structure through an appropriate heat treatment and that nanocrystalline microstructures often impart superior mechanical properties (compared to larger grains polycrystalline and amorphous materials). Wang teaches the formation of a nanocrystallized surface layer on a steel (stainless steel 304) by an analogous severe plastic deformation method and taught that annealing the formed nanocrystallized surface layer in the claimed temperature and time range produces improvements in hardness and robustness of the passivation film.

With respect to the amendment adding “with said ultrasonic impact treatment of said surface layer providing equiaxial grains in said surface layer”, Wang discloses that his severe plastic deformation process that yields nanocrystalline grains produced

roughly equiaxed grains (p. 3940, col. 2, para 3) and Lu further adds that many examples of equiaxed grains formed by nanocrystallization from an amorphous precursor (p. 162, para 3; p. 166, para 4; p. 168, para 3; p. 169, para 3; and p. 189, para 4).

With respect to the amendment adding the heat treatment temperature and time range, Lu teaches both annealing temperature and time to be art recognized, result effective variables in transforming an amorphous microstructure to a nanocrystalline microstructure. It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify either of these variables depending the crystallization kinetics and thus final microstructure desired.

Wang then teaches a heat treatment with a temperature and time within the claimed range. From MPEP § 2144.05: In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). In addition, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003).

Alternatively, it would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization, since it has been held that there the general conditions of a claim are

disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See In re Boesch, 205 USPQ 215 (CCPA 1980).

One would be motivated to combine Statnikov in view of Lu and Wang because Lu taught the specifics of how to produce nanocrystalline materials and the advantages of them above amorphous materials while Wang taught a specific heat treatment that is demonstrated to increase hardness.

Regarding claim 3, Lu teaches that mechanical alloying (aka mechanical attrition) is a known way of producing nanocrystalline materials (p. 162, para 3, lines 4-9). Furthermore Lu points out that mechanical attrition (mechanical alloying) have been most commonly employed to produce large quantities of nanocrystalline samples up to now (p. 163, para 1, lines 1-7).

Regarding claim 4, Lu teaches that "[C]ontrolled crystallization of amorphous alloys can be used to obtain partially crystallized materials with nanometer-sized crystallites embedded in the residual amorphous matrix." (p. 164, para 2, lines 1-2). This crystal structure is advantageous in obtaining excellent mechanical or magnetic properties (p. 164, para 2, lines 2-4).

Regarding claim 5, it would have been obvious to one of ordinary skill in the metallurgical arts at the time the invention was made to shield the surface of a metallic material from air during ultrasonic impact treatment as shielding a surface from contact with air during a metallurgical treatment is a well known technique (see W Toman et al, Protective Gases, in *Ullmann's Encyclopedia of Industrial Chemistry*, Wiley-VCH Verlag GmbH & Co, online June 15 2000.) in the metallurgical arts and one would have a

reasonable expectation of success in applying this known technique to a new process to avoid oxidation or other contamination as neither the technique nor the process would be altered by the combination.

Response to Applicant's Arguments:

4. Applicant's arguments filed January 28th, 2009 have been fully considered but they are not persuasive.

Applicants assert (p. 5) that the instant claims require the creation the equiaxial grains in the surface layer by ultrasonic impact treatment while Statnikov produces a different microstructure of a white amorphous layer.

In response, with respect to the amendment adding "with said ultrasonic impact treatment of said surface layer providing equiaxial grains in said surface layer", Wang discloses that his severe plastic deformation process that yields nanocrystalline grains produced roughly equiaxed grains (p. 3940, col. 2, para 3) and Lu further adds that many examples of equiaxed grains formed by nanocrystallization from an amorphous precursor (p. 162, para 3; p. 166, para 4; p. 168, para 3; p. 169, para 3; and p. 189, para 4).

Applicants assert (p. 6) that Lu does not teach how to obtain a nanocrystallized surface layer on a steel product and that Lu does not teach the heat treatment parameters claimed.

In response, with respect to the amendment adding the heat treatment temperature and time range, Lu teaches both annealing temperature and time to be art

recognized, result effective variables in transforming an amorphous microstructure to a nanocrystalline microstructure. It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify either of these variables depending the crystallization kinetics and thus final microstructure desired.

Wang then teaches a heat treatment with a temperature and time within the claimed range. From MPEP § 2144.05: In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). In addition, "[A] prior art reference that discloses a range encompassing a somewhat narrower claimed range is sufficient to establish a prima facie case of obviousness." *In re Peterson*, 315 F.3d 1325, 1330, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003).

Conclusion

-- Claims 1-5 are rejected
-- No claims are allowed

The rejections above rely on the references for all the teachings expressed in the texts of the references and/or one of ordinary skill in the metallurgical art would have reasonably understood or implied from the texts of the references. To emphasize certain aspects of the prior art, only specific portions of the texts have been pointed out. Each reference as a whole should be reviewed in responding to the rejection, since other sections of the same reference and/or various combinations of the cited references may be relied on in future rejections in view of amendments.

All recited limitations in the instant claims have been met by the rejections as set forth above. Applicant is reminded that when amendment and/or revision is required, applicant should therefore specifically point out the support for any amendments made to the disclosure. See 37 C.F.R. § 1.121; 37 C.F.R. Part §41.37 (c)(1)(v); MPEP §714.02; and MPEP §2411.01(B).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark L. Shevin whose telephone number is (571) 270-3588 and fax number is (571) 270-4588. The examiner can normally be reached on Monday - Friday, 8:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy M. King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

/Mark L. Shevin/
Examiner, Art Unit 1793

April 9th, 2009
10-535,346

/George Wyszomierski/
Primary Examiner
Art Unit 1793